Evaluation of Drinking Water Treatment Technologies for Removal of Endocrine Disrupting Compounds

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Many of the chemicals identified as potential endocrine disrupting compounds (EDCs) may be present in surface or ground waters used as drinking water sources due to their introduction from:

- Domestic and industrial sewage treatment systems.
- Wet-weather runoff.

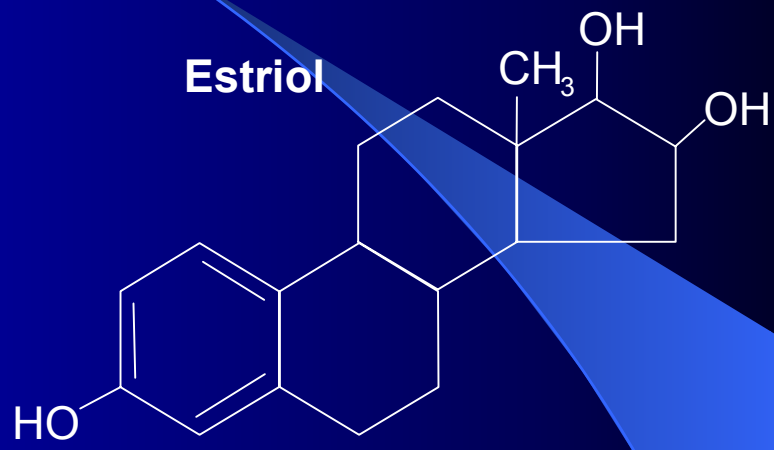
Basic strategies to decrease the potential risk of adverse health effects associated with the presence of EDCs in drinking water:

- Protect drinking water sources from contamination by EDCs.
- Remove EDCs, that may be present in source waters, during drinking water treatment.

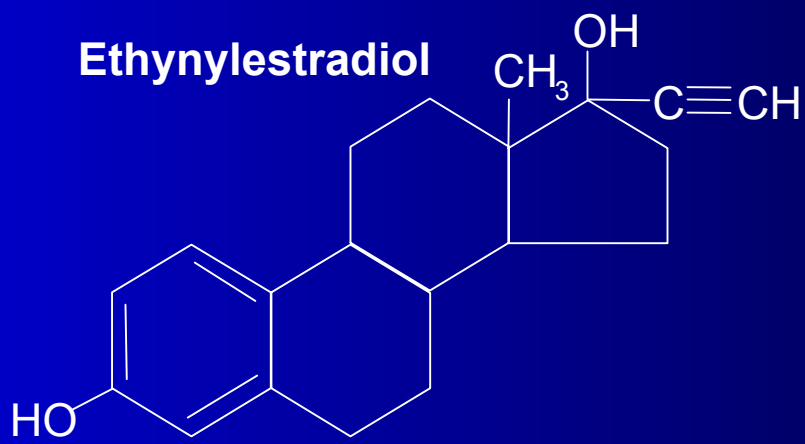
Compounds to be evaluated

Estradiol

Estriol

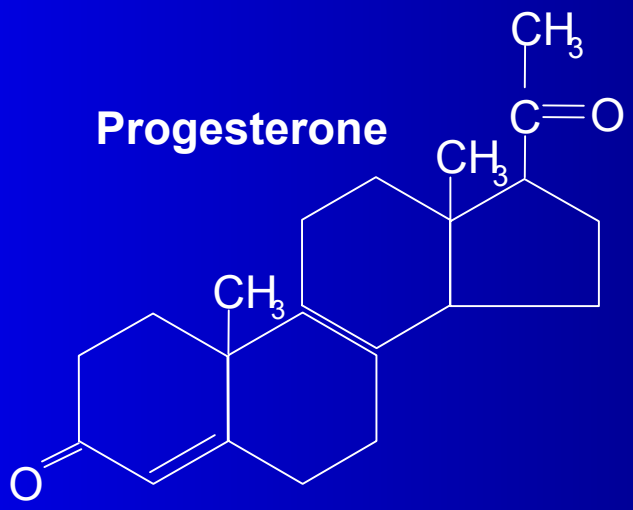


Ethynylestradiol

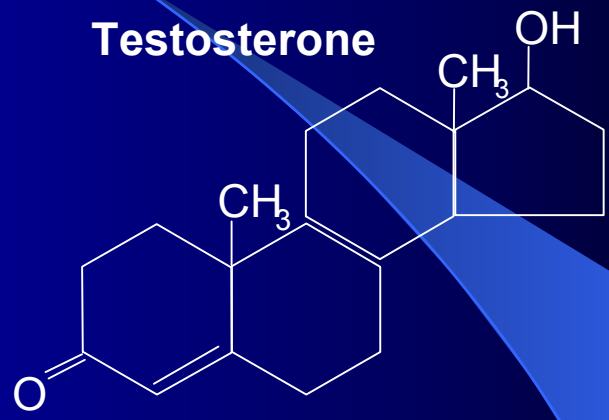


Compounds to be evaluated

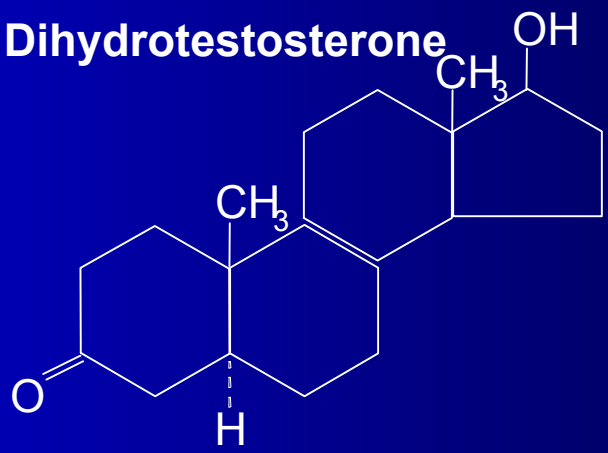
Progesterone



Testosterone



Dihydrotestosterone



Additional compounds to be evaluated in the future

- 4-nonylphenol (NP)
- 4-nonylphenol mono-ethoxylate (NP1EO)
- 4-nonylphenol diethoxylate (NP2EO)
- 4-nonylphenoxy carboxylic acid (NP1EC)
- 4-nonylphenoxy ethoxy carboxylic acid (NP2EC)

Technical approach

- Develop analytical methods to identify and quantify the target compounds. The approach will include concentration by solid-phase extraction, followed by LC/MS.

Analytical method for steroid compounds

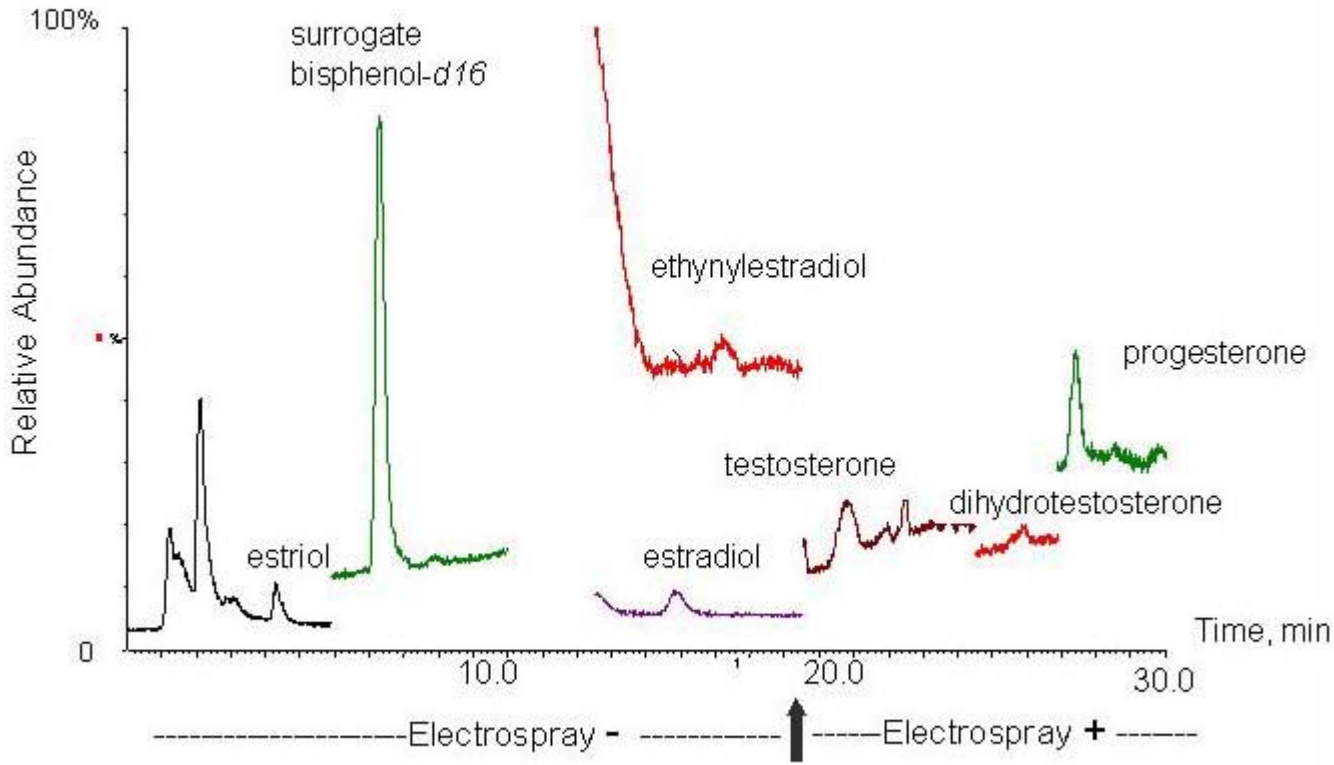
Solid phase extraction:

- Baker C18 XF speed disks eluted with methanol

Quantitation:

- Waters ZQ LC/MS, electrospray
- Xterra C18 column
- Single step gradient, 50 – 65% methanol in ammonium hydroxide in water
- Single ion mode

Single ion chromatograms of reagent water fortified at 1ng/L



Technical approach (cont.)

- Evaluate the use of a reporter gene assay, the MVLN assay, to detect the presence/ removal of estrogenic activity. This assay uses a human breast cell line (MCF-7) which has been stably transfected with the firefly luciferase gene.

Technical approach (cont.)

- Conduct bench-scale evaluations of various drinking water treatment technologies, including conventional treatment, granular activated carbon, softening and nanofiltration.
- Pilot-scale evaluations may be conducted on the treatment technologies that appear promising at bench-scale.

This study will provide information on:

- currently available drinking water treatment technologies that can remove EDCs, specifically the steroid hormones and the nonylphenolic compounds.
- approaches to optimize these treatment technologies for EDC removal.
- the need for additional management tools to be developed for the removal of EDCs during drinking water treatment.